

Integrated Microgrid Energy Management System with Proactive and Comprehensive Control

Market and Background

The global energy microgrid market is projected to grow from \$19.2 billion in 2017 to \$39.1 billion by 2023, increasing at a compounded annual growth rate of nearly 12%. Many factors are driving this growth. On the macro scale, rapid industrialization, improving economic development, and global deployment of sustainable energy sources are major contributors. Other drivers include measures to increase power supply stability and security, growing off-grid networks across developing nations, and deployment of captive power generation by the industrial sector as an alternative to the regulated electricity supply. In addition, overall costs for microgrids have declined by 25-30% since 2014. North America is presently the leading market and is expected to remain strong in the coming decade. Over the same period, the Asia Pacific is projected to become the leading market based on population growth and opportunities created by the current lack of traditional grid infrastructure.

The growth in the microgrid market comes with a corresponding demand for judicious utilization and management of power. In addition, the movement towards environmental sustainability has led to the incorporation of more renewable energy sources and non-traditional types of power loads in microgrid applications, including solar panels, wind turbines and electric vehicles. While typical existing microgrid energy management techniques focus on the inclusion of renewable resources in the supply of power, they do not use the renewable resources to their full power generation capacity and also ignore the interaction between the microgrid and the utility grid. This insufficient microgrid energy management leads to longer payback periods for the installation of renewable resources and higher microgrid operation costs than necessary.

Research and Development Status:

Electrical and software engineers at the University of Wisconsin-Platteville have developed a novel, software-based, microgrid energy management system that improves upon existing technology in several ways. This innovation achieves coordinated and optimal control of various energy resources throughout the microgrid system by integrating real power, reactive power and voltage control into the same stage. This proactive and comprehensive microgrid energy management was demonstrated to provide up to 20% improvement in the utilization of the power-generating capacity of renewable resources, which can especially help industrial facilities to meet minimum power factor thresholds set by utility companies and avoid monetary penalties. In addition, it enables interaction between the microgrid and utility power grid to allow the microgrid to facilitate utility power grid operation, which can help increase microgrid revenue.

This technology has been successfully tested under different weather types, load profiles and outages in a real-world, building-based microgrid environment that includes the utility grid power supply, rooftop solar panels, capacitor banks and various building electric loads.

Applications:

- Individual buildings
- Campuses and bases – industrial, academic, commercial, military
- Islands and remote sites
- Small cities and communities

Key Benefits:

- Building block for smart grids
- Reduction in electric bills:
 - Improved energy efficiency
 - Up to 20% improvement in utilization of renewable resource power generation capacity
 - Up to 3.8% improvement in power factor to meet utility grid thresholds and avoid monetary penalties
- Integrated and coordinated control of real power, reactive power and voltage for all resources on the microgrid
- Customer facilitation of utility grid operation
- Reduction in environmental impact
- Enhanced power quality and service reliability

Intellectual Property:

A U.S. Patent Application has been filed for this technology. The final product will be software that runs on a computer or embedded hardware and allows end users to control microgrid components automatically or manually. For more information, please contact Jennifer Cook at jennifer@wisys.org or by phone at 608-316-4131.

Development and Commercialization Needs:

WiSys is currently seeking a strategic partner in the power monitoring and control industry that is interested in further developing this innovative energy grid management system, ultimately providing a route to market for its commercialization.